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Journal of the Society of Arts.

FRIDAY, SEPTEMBER 4, 1868.

Announcements by the Council.

EXAMINATIONS, 1869.

The Programme of Examinations for 1869 is now published, and may be had *gratis* on application to the Secretary of the Society of Arts.

PRIZES.

The Council, at the suggestion of the Food Committee, offer the following prizes for Improved Railway Meat Vans, Milk Vans, and Milk Cans:—

1. For an improved method of conveying meat by rail, the Society's *Silver Medal* and £10.

The object in view is to reduce to a minimum the deterioration which meat now suffers in its transit by rail. The principal evils to be avoided are—excessive changes of temperature, and injuries by pressure, by handling, exposure to dust, insects, &c. This prize may be awarded for an improved railway meat van or for a travelling meat larder suitable for railways.

Model on a scale of half an inch to a foot to be sent in.

2. For an improved method of conveying milk cans by rail, the Society's *Silver Medal* and £10.

The object in view is to reduce to a minimum the deterioration which milk now suffers in its transit by rail in the ordinary open trucks. The principal evils to be avoided are—the heating and shaking of the milk cans.

Model of an improved railway milk van, on a scale of half an inch to the foot, to be sent in.

3. For an improved railway milk can, the Society's *Silver Medal* and £10.

The object in view is to reduce to a minimum the deterioration which milk now suffers in its transit by rail in the ordinary milk cans, or "churns." The principal evils to be avoided are—the heating of the milk, and all motion within the can which may cause the buttery particles to separate.

A specimen of the improved railway milk-can to be sent in.

The models and specimens for competition must be forwarded to the Secretary of the Society of Arts before the 1st February, 1869.

HARVESTING CORN IN WET WEATHER.

The Essay by Mr. W. A. Gibbs, of Gillwell-park, Sewardstone, Essex, for which the Gold Medal of the Society and a prize of Fifty Guineas were awarded, is now ready. Published by Messrs. Bell and Daldy, York-street, Covent-garden, publishers to the Society of Arts; price one shilling, illustrated by woodcuts.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

CANTOR LECTURES.

"ON FOOD." By DR. LETHEBY, M.A., M.B., &c.

LECTURE III., DELIVERED MONDAY, FEBRUARY 3.

Construction of Dietaries: Preparation and Culinary Treatment of Foods.

(Continued from page 110.)

Treatment of Foods.—In the treatment of vegetable foods it is important to remember, that all corky and woody tissues, as the skins of fruits, tubers, and cereals, are quite indigestible, and that in consequence of their irritating action they hurry food through the alimentary canal, and so occasion waste. It is necessary, therefore, that all such tissues should be removed as completely as possible.

When it is required to obtain the *starchy* or *farinaceous* matters of vegetables, one or other of the following processes is followed.

(a). The material is pulped or crushed, and diffused through a considerable volume of cold water. It is then strained and allowed to stand until the farina or starch subsides.

(b). Or it is allowed to pass into a state of putrefactive decomposition, whereby the albuminous matter, as the gluten, &c., decay and leave the starch untouched.

(c). Or it is subjected to the action of a weak alkaline solution, generally of caustic soda, which dissolves the gluten, and allows the starch to subside. The gluten thus dissolved may be again recovered by neutralizing the alkaline solution with acid, and collecting the precipitated gluten, as in the processes of Durand and others.

I have already explained that in the treatment of the ground meal of wheat and other grain, the bran and coarser kinds of flour are separated by sieves of different degrees of fineness, and that in this manner about eight or nine varieties of product are obtained, as *biscuit flour*, *best or fine households, seconds, tails, fine sharps or middlings, coarse sharps, fine pollard, coarse pollard, and long bran*, the proportions of these from ordinary brown meal will vary according to circumstances, but processes have been invented, as by M. Mège Mouries, M. D'Arblay, and others, whereby the yield of fine flour is increased to 86 or even to 88 per cent. of the grain, and by which the quantity of gluten is also regulated.

When the flour is rich in gluten, as in the case of the hard wheats of Sicily, Russia, Sardinia, and Egypt, they are well suited for the manufacture of certain granular powders and dried pastes, which are known as *Semola*, *Semolina*, *Soujee*, *Mammaeroup*, *Maccaroni*, *Vermicelli*, and *Cagliari paste*. The last three are generally imported from Naples or Genoa, where they are made from a highly-glutinous wheaten flour, by kneading it into a thin dough or tenacious paste, and then forcing it through holes or slits in a metallic plate. In this way the several varieties of *pipe*, *celery*, and *ribbon maccaroni* are obtained; and the fancy forms of it, called *Cagliari paste*, which are in the shape of stars, rings, Maltese crosses, &c., are produced by stamps. All these varieties of raw wheaten paste are cooked by boiling or baking, and are associated with soup or beef-tea, or milk, or are mixed with eggs, cheese, &c.

The best variety of flour for bread is that which contains less gluten than the preceding, as from 8 to 10 per cent. of it instead of from 12 to 14 or 15. Dantzic flour, and soft Spanish, as well as the American called *Genessee*, are the best examples of it, and are highly esteemed by bakers on account of the fine quality of bread which is procurable from them; the richer varieties of hard glutinous wheat being used only to impart strength to weak and inferior descriptions of flour.

Bread, which is the most important preparation of

flour, owes its value as an article of diet to a good and equable vesiculation of the dough, the vesiculation being effected by the diffusion of small bubbles of carbonic acid gas throughout its substance; and, as this vesiculation can only take place in a proper manner when the gluten of the flour is in sufficient quantity, and of good quality, it is, to some extent, a test of the goodness of the meal. Those flours which contain too little gluten, or gluten which is deficient of strength, cannot be vesiculated into bread. This is the case with almost every description of flour, excepting that of wheat and rye.

The most common, and also the most ancient method of vesiculating bread is by fermentation; and the process is not very different from what it was in very early times, when we were told that "a little leaven leaveneth the whole lump." Yeast of some sort—as brewers' yeast; or patent yeast, prepared from infusion of malt and hops; or German yeast, which is the solid residue of the yeast produced by the fermentation of rye for making Hollands; or bakers' yeast, which is made from potatoes and flour; or leaven, which is old dough in a state of fermentation, is mixed with the flour or dough, which soon begins to ferment by the action of the yeast fungus (*microderma cerevisiæ*) on the sugar of the flour. Carbonic acid is thus produced; and by being diffused through the substance of the dough it vesiculates it, and causes it to rise or swell. The most usual practice with the baker is somewhat as follows:—A special ferment is prepared from mealy potatoes (technically called *fruit*) by boiling them in water, mashing them, and allowing them to cool to a temperature of about 80° of Fahrenheit. Yeast is then added to them, together with a little flour to hasten the fermentation. In three or four hours, at a proper temperature (as from 80° to 90° Fah.), the whole mass is generally in a state of active fermentation, with a sort of cauliflower-head. It is then diluted with water and strained, and is mixed with sufficient flour to make a rather thin dough, which in about five hours rises to a fine *sponge*. This is again diluted with water containing salt, and is worked with the necessary quantity of flour into dough, and allowed to stand for two or three hours, when it rises, and is in a fit condition to be baked into loaves.

It can hardly be said that the potatoes are an adulteration in this case, for they do not ever amount to more than 6 lbs. to a sack of flour, which makes about 380 lbs. of bread, or 95 4-lb. loaves. The salt is added to the extent of about 4 lbs. or more to a sack of flour, the proportions being regulated according to circumstances, for the object of it is to improve the quality of the loaf as regards whiteness, firmness, and flavour.

There is, no doubt, a slight loss of nutritive matters by this mode of vesiculation, for a small portion of the sugar of the flour is converted into alcohol and carbonic acid, but the quantity is so inconsiderable as to be undeserving of notice. The advantage of the process, however, is that it is an excellent test of the quality of the flour; for weak flour, or flour that has been injured by germination, or by keeping, will not stand the action of yeast, but will be either ropy, or sticky, or heavy, when baked into bread.

Another method of vesiculation is to generate carbonic acid in the dough by the action of an acid on bicarbonate of soda. Dr. Whiting's process, which was patented in 1836, was to mix the carbonate of soda with the flour, and then to act on it with a proper proportion of muriatic acid added to the water. He used from 350 to 500 grains of carbonate of soda to 7 lbs. of flour, and to this he added 2½ pints of water charged with from 420 to 560 grains of muriatic acid. Other proportions are used by bakers who make unfermented bread; but in all cases the proportions should be such as to form common salt (which is the product of the action of muriatic acid on carbonate of soda)—the carbonic acid being liberated in the substance of the dough. Care should be taken that the muriatic acid is pure, for that found in commerce is generally highly charged with arsenic.

In 1845, another acid was patented instead of muriatic—namely, tartaric; and the various preparations called *baking-powders*, *custard-powders*, *egg-powders*, &c., are nothing but mixtures of tartaric acid and carbonate of soda, with a little farinaceous matter, the common proportions being 1 part of tartaric acid, 2 of carbonate of soda, and 4 of potato-flour or other dry starch, with a little turmeric powder to give it a rich yellow tint. When this is mixed with flour and wetted, it effervesces, as in the case of a common seidlitz powder, and so diffuses the carbonic acid through the dough.

Very lately, Mr. McDougall has proposed the use of phosphoric acid, as a more natural constituent of food than the preceding, and this, with an alkaline carbonate, forms the preparation which is known as *phosphatic yeast*.

A third process, which is now extensively used in the vesiculation of bread, is that of Dr. Daughlish, and by which the bread called *aerated* bread is obtained. It consists in the addition of a solution of carbonic acid in water to flour under pressure. The mixture is made in a closed air-tight vessel, in which the dough is well kneaded by machinery, and directly the outlet of the vessel is opened, and the pressure thus removed, the gas escapes from the water, as in the case of an uncorked bottle of soda-water, and expands into little bubbles within the substance of the dough. By its expansion, also, it forces itself out of the mixing-chamber, and rises into a spongy dough.

In all cases, however, where carbonic acid is generated within the dough by other processes than fermentation, the dough must be baked immediately or it will fall, and the loaf be heavy. Various contrivances have been suggested for helping the process of kneading, which is laborious, and sometimes not altogether cleanly work. Mr. Stevens' hand-machine appears to accomplish this very well. It is in use in the Holborn Union, where about 5,633 lbs. of bread are made every week by one man and two boys; and they contrive to make ninety-six 4-lb. loaves out of every sack of flour (280 lbs.). The materials used on the average of a whole year being as follows:—

PROPORTIONS PER WEEK.

Flour	4,129 lbs.	} Which produce 5,633 lbs. of bread, or 1,408 4-lb. quatern loaves.
Cones	140 "	
Potatoes	168 "	
Salt	68 "	
Malt	13 "	
Hops	1½ "	

The potatoes, the malt, and the hops, are for the purpose of making the yeast or ferment for the bread.

But, by whatever process bread is made, it is necessary to observe certain precautions to ensure the production of a good loaf.

1st. The flour should be from sound grain, sufficiently rich in good gluten.

2nd. The yeast should be sweet, and should show a lively action in the sponge.

3rd. The dough should be well kneaded to insure the thorough diffusion of the gas, and to give toughness to the gluten.

4th. The salt should be used in such proportion as to regulate the fermentation, and give firmness to the gluten, whiteness to the bread, and a good flavour.

5th. The baking should be so managed as to insure the thorough heating of the loaf to the temperature of at least 212° of Fahrenheit, in order that the insoluble starch may be changed by the heat into soluble dextrine; and the crust should be light-coloured and thin. This is best effected when loaves are baked singly, as on the Continent, and not in batches, as with us; for in the last case, the top and bottom crusts are thick and hard, and are frequently scorched, while the interior of the loaf is doughy and under-done.

Specimens of the different kinds of bread of England and the Continent are upon the table; and you will notice

the dark colour of the *rye-bread* of Europe. I am indebted for these illustrations to the kindness of Mr. Twining, who has liberally placed the valuable collection of foods in his museum at our disposal. Here, also, is a sample of rye-bread supplied by Mr. William Ray Smee, who, in the interest of the poor, has had it made according to the formula of the Board of Agriculture of 1795. It consists of one part of rice and four parts of rye ground together, and sifted in the usual manner. The meal is then made into dough with yeast; and when fermented is baked in the form of long rolls. The bread is very dark, like all rye-bread, and has a close texture, but it is agreeable to the palate, and is very nutritious. The great recommendation of it is its cheapness, for it can be made at less than a penny a pound, and is therefore a very suitable bread for the poor.

Those flours which do not contain sufficient gluten of the proper quality for fermentation or vesiculation, as barley-meal, oat-meal, Indian-meal, and the flour of peas and lentils, are best cooked by baking them in the form of cakes or biscuits—a practice which is as ancient as the time of the Patriarchs, when, during the Passover, they were commanded to eat unleavened bread. The chief food of the common people of Rome was a heavy kind of unleavened bread, like the present *polenta* of the Italians, which is made of Indian meal and cheese. As in former time, biscuits and unfermented cakes are made from meal or flour mixed with water and baked; but the texture of the substance is close, and it is not easy of digestion unless it is thoroughly disintegrated. When biscuits are lightened by means of egg and sugar, with a little butter, they are much more digestible; and they are still more so when they are vesiculated and puffed up by means of a small quantity of carbonate of ammonia, as in the case of *cracknels* and *Victoria biscuits*.

The so-called *farinaceous foods* for infants are only baked flour, sometimes sweetened with sugar. The flour must be baked until it acquires a light-brown colour, the temperature being about 400° or 450° of Fahrenheit. The granules of starch are then disintegrated, and converted into a soluble substance, named *dextrin*—which, by a further process of cooking or boiling, as in making pap, forms, when properly sweetened, a very excellent food for children. *Tops* and *bottoms* owe their value to the same circumstance—namely, that the farinaceous matter, which is indigestible within infants, is broken up by baking into soluble dextrin.

All varieties of meals and arrowroots are easily cooked by stirring them into boiling water, or boiling milk, until they have the consistence of gruel or hasty pudding, and then boiling for a few minutes. In the case of Indian-meal, rice, split-peas, lentils, and haricots, the boiling should be continued for a considerable time, and the whole grain should be previously steeped in water for many hours; for the starch and cellulose of these vegetables are not digestible unless they are thoroughly disintegrated by cooking. It may be said, indeed, that all vegetables with dense tissues require prolonged boiling to cook them, for cellulose is not capable of digestion by man unless it is broken up by the action of heat—even starch is likely to pass through the alimentary canal unchanged, if it be not rendered soluble by fermentation or cooking. It is an important question, whether in utilizing starchy foods, it may not be advantageous to help their transformation by allowing the grain to germinate to some extent, as in the process of malting, when the starch is changed into sugar. Mr. Lawes has examined this question, and has concluded, from his experiments on stock, that in the case of pigs and bullocks the fattening effect of the grain is not increased; but it may be different with the human stomach, where the transformation power is not nearly so active as with lower animals. Here, in fact, is an example of it:—The food which Liebig recommends for infants is a preparation of malt with wheaten-flour and milk, to which a little bicarbonate of potash has been added; and the reputation of it in Germany, as an article of diet for

children, is considerable. The preparation is made by mixing one ounce of wheaten flour with ten ounces of milk, and boiling for three or four minutes; then removing it from the fire, and allowing it to cool to about 90°. One ounce of malt-powder previously mixed with 15 grains of bicarbonate of potash, and two ounces of water, are then stirred into it, and the vessel being covered, is allowed to stand for an hour and a-half, at a temperature of from 100° to 150° Fahrenheit. It is then put once more upon the fire, and gently boiled for a few minutes. Lastly it is carefully strained, to remove any particles of husk, and then it is fit for the child's food. The composition of the food, according to Dr. Liebig, is as follows:—

Foods.	Plastic matter.	Carbonaceous matter.
	oz.	oz.
10 oz. milk	0.40	1.00
1 oz. wheat-flour	0.14	0.74
1 oz. malt-flour	0.07	0.58
	0.61	2.32

The relation of the plastic to the carbonaceous being as 1 to 3.8, which is the right proportion for the food of children.

The effect of the malt-flour is to transform the starch into glucose, and thus the mixture gets thinner and sweeter as it stands; and the bicarbonate of potash is added to facilitate the change, and to neutralize the acid constituents of the flour and malt.

Liebig's extract of malt is another such preparation for a quick assimilation of starchy matters.

Vegetable substances are occasionally fermented, either for the purpose of increasing the relative amount of glutinous matter, or for the purpose of rendering them acid. Potatoes, for example, as well as barley, wheat, and rye, leave a residuum after fermentation, which contains more gluten than the original substance, in consequence of the transformation of sugar and starch into alcohol; and although the residuum is coarse, and is hardly suited for human consumption, yet it is an excellent food for cattle: in fact, in Germany it is often eaten by the poor.

When the process is carried still further, and the mass acquires an acid property in consequence of the formation of acetic, butyric, and lactic acids, various sour preparations are obtained, which are no doubt useful in assisting the digestion of other foods. The ancient Romans had many such fermented substances which were not unlike the *sauer-kraut* of the Germans. This, as you know, is made from the leaves of cabbages, gathered generally in autumn, and from which the stem and mid-rib are removed. They are cut up into thin slices, and are placed in a tub or vat, alternately with layers of salt, until the vessel is full. It is then subjected to pressure, and allowed to stand for five or six weeks (according to the temperature); the lactic fermentation is thus set up, and the mass becomes sour. It is cooked by stewing it in its own liquor with bacon, pork, or other fat meat; and certain condiments, as dill or carraway, are added to improve its flavour. In Prussia, and in many parts of Germany, there is a similar preparation of fermented beans; and in Holland and the South of Europe, cucumbers are fermented. We also have our pickled vegetables, in which acetic acid takes the place of lactic acid. All these preparations are no doubt aids to digestion, especially when the fibre of meat is tough, and contains tendon, or hardened cellular tissue. This is especially so with salted meat, and, therefore, a little pickle is always a good and palatable addition to cold boiled beef.

Vegetable substances, as *tea*, *coffee*, *malt*, *cocoa*, &c., the infusions of which are used as beverages, are prepared for commerce in nearly the same manner. When taken from the tree, and while in a fresh condition, they are

allowed to undergo a moderate kind of fermentation, and they are then dried and roasted. In the case of tea, the roasting operation is performed during the process of drying and curling, by heating the leaves upon wire-sieves held over a charcoal fire, but cocoa and coffee are roasted in metallic cylinders, which are kept revolving over a clear fire—coffee being roasted until it is partially charred, and has lost from 14 to 20 per cent. in weight. By this means the aroma, or volatile oil, is, in each case, produced; and there is also an empyreumatic change in the astringent acids, the sugar, the gum, and the starch, whereby extractive matters, varying in amount and quality, according to the degree of heat, are formed. Shrader has examined the subject in respect of coffee, and has ascertained that the following are the proportions of the several constituents in raw and roasted coffee:—

	Raw Coffee.	Roasted Coffee.
Peculiar coffee principle	17.58	12.50
Gum and mucilage	3.64	10.42
Fatty matter and resin	0.93	2.08
Extractive	0.62	4.80
Woody tissues and cellulose	66.66	68.75
Mixture, &c.	10.57	1.45
	100.00	100.00

Infusions of tea and coffee should be made with boiling water, but they should never afterwards be boiled, for the aromatic principle is very volatile, and would be thus lost; besides which a decoction of tea or coffee is disagreeably bitter on account of the solution of the coarse forms of extractive matter. Soft water also extracts these matters, and, therefore, appears to give a stronger infusion than moderately hard waters, but it is always at a sacrifice of delicate flavour. Excellent tea is made in London with water of 14 or 15 degrees of original hardness, and of about 5 degrees when boiled. This was a subject of investigation by the Government Chemical Commission (Professors Graham, Miller, and Hofmann), who were appointed in 1851 to inquire into the chemical quality of the water supply of London; and they reported that in their experiments they found that tea made from the boiled London water of 5 degrees of hardness, could not generally be distinguished from tea made with water of 2½ degrees only, although a delicate palate would recognise a slightly increased bitterness without any enhancement of flavour in the latter. It would seem, indeed, that moderately hard water makes the best flavoured tea, provided it is allowed to stand upon the tea sufficiently long. In the case of the Greenwich pensioners the tea was made from water of 24 degrees of hardness before boiling, and 18.6 degrees after; but the infusion was maintained for half-an-hour, by surrounding the vessel with a steam case; and thus an excellently flavoured tea was obtained. The Commissioners indeed truly remark, that “where any great loss of strength of tea infusion has been observed in passing from a soft water to a harder, it may be probably referred to the circumstance that the mode of infusing it has not been properly adapted to the hard water; and then there is doubtless some waste of tea.” Lake waters have been a good deal extolled on account of their softness and supposed fitness for making tea, solely because they happen to produce a deep-coloured solution, which conveys a false notion of strength; but, in reality, flavour is always sacrificed for the mere look of the thing, there being no increase of physiological or dietetical property. The Chinese, who are very good authorities on this subject, never use either very soft or very hard waters, for their rule is to take the water of a running stream—“best from the hill side, and next from a river.” We may conclude, therefore, that water of from four to seven degrees of

hardness after being boiled, is best suited for infusions of tea and coffee; for such water dissolves the aromatic and physiological constituents, without extracting the disagreeable bitter principles. In the case of coffee, in fact, a little acid, as a portion of lemon juice, improves the flavour, notwithstanding that it adds to the hardness of the infusion. Experimentally it is found that infusions of tea and coffee are strong enough when the former contains 0.6 per cent. of extracted matter, and the latter 3 per cent., so that a moderate sized cup (5 oz.) should contain about 13 grains of the extract of tea, or 66 grains of coffee. These proportions will be obtained when 263 grains of tea (about 2½ teaspoonfuls), or 2 oz. of freshly roasted coffee are infused in a pint of boiling water; and the amounts of the several constituents dissolved are about as follows:—

Constituents.	Tea.	Coffee.
	grs.	grs.
Nitrogenous matters	17.2	44.0
Fatty matter	3.0
Gum, sugar, and extractive	31.7	103.2
Mineral matters	9.1	22.8
Total extracted	58.0	173.0

So that tea yields to a pint of fresh water about 22 per cent. of its weight, and coffee about 20 per cent. Lehmann found that only 15½ per cent. of tea was dissolved by water; whereas, Sir Humphrey Davy estimated it at 33½ per cent. No doubt the quality of the water as well as that of the tea affects the results, for distilled water will extract from 40 to 44 per cent. of black tea, and nearly 50 per cent. of green; but for all this, about 22 per cent. is a good average.

Tea is generally measured into the tea-pot by the spoonful, and Dr. Edward Smith has made a curious inquiry into the average weights of a spoonful of different kinds of tea. The results are here shown:—

WEIGHT OF A SPOONFUL OF TEA.

Black Teas.		Green Teas.	
	Grs.		Grs.
Oolong	39	Hyson	66
Congou (inferior) ..	52	Twankay	70
Flowery Pekoe ..	62	Fine Imperial	90
Souchong	70	Scented Caper	103
Congou (fine)	87	Fine Gunpowder ..	123

From which it would seem that from three to seven teaspoonfuls of black tea, or from two to four of green, are required for a pint of infusion of the strength already given.

Cocoa is best made by boiling the mixture for a little while, for it nearly always contains a large proportion of starchy matter, which has been added to dilute the rich fat of the cocoa. Indeed cocoa contains so much butter or solid fat (from 48 to 50 per cent.), that it is necessary to reduce it with some easily digestible substance, as starch, lentil powder, carageen moss, Iceland moss, sugar, &c.—hence the various preparations of it called *granulated cocoa*, *soluble cocoa*, *chocolate*, &c., the processes for making which I will briefly describe. When the berry is roasted and is cold, it is passed through a machine called a “kibbling-mill,” which deprives it of its husk, and of the thin skin which surrounds the kernel or nib. If the nibs thus cleaned are ground in proper mills, they form the variety of cocoa called *flaked cocoa*, but if other preparations are to be made, the nibs are ground between heated rollers or otherwise, until they form a smooth paste, when the diluting substances are mixed with it and are thoroughly incorporated. If *soluble cocoa* is to be made, the diluting material is sugar with some kind of arrowroot, as tousel-mois, maranta, curcuma, &c. If *chocolate* is required, the diluting material is sugar only, with some flavouring agent, as vanilla; and if fancy preparations, as *carageen*

moss cocoa, *Iceland moss cocoa*, *lentil cocoa*, &c., are required, then these several substances are incorporated. *Granulated cocoa* is a preparation of cocoa, with sugar and starch, so ground as to form a coarse powder, in which the particles of broken cocoa are covered with a layer of sugar and starch. It is obvious that whenever the mixture consists of starch or other farinaceous substance, the solution of the cocoa preparation must be boiled; but when sugar has been used, as in chocolate, which is the most ancient preparation of it, the combination is such as to require no culinary treatment, or, at most, the action of boiling water or boiling milk.

It is remarkable that, although cocoa is much less used than either tea or coffee, yet it was known in Europe a century before either of the others. As early, indeed, as 1520 it was brought from Mexico by Columbus, who found it the common beverage of the people; and when Cortes was entertained at the court of the Aztec Emperor, Montezuma, he was treated to a sweet preparation of the cocoa, called *chocolatl*, flavoured with vanilla and other aromatic spices, and served to him in a golden vessel. The Spaniards thus acquired a knowledge of the berry and of its chief preparation, which they kept secret for many years, selling it very profitably as *chocolat* to the wealthy and luxurious classes of Europe. It was, however, an expensive preparation, and did not come into general use until long after the public coffee-houses of London were established. The earliest notice of it, according to Hewitt, is in Needham's *Mercurius Politicus*, for June, 1659, wherein it is stated that "chocolate, an excellent West India drink, is sold in Queen's Head-alley, in Bishopsgate-street, by a Frenchman, who did formerly sell it in Gracechurch-street and Clement's-Churchyard, being the first man who did sell it in England;" and its virtues are highly extolled. This was about five years after the London coffee-houses had been established, for the first of them is said to have been opened in 1650, by a Levantine named Pascal Rossee, in St. Michael's-alley, Cornhill; and a year after they were opened in Paris and in Holland. In 1660 they were so much frequented, and coffee was so largely drank, that they were made a source of revenue, a tax of 4d. a gallon being levied on all the coffee drank in them; and three years later they were regularly licensed at the Quarter Sessions, like common taverns. In 1668, when Ray, the distinguished naturalist, published his "History of Plants," he tells us they were as numerous in London as at Cairo; and at last they became so great a nuisance, on account of their political associations, that in 1675 Charles the Second endeavoured to suppress them by proclamation, calling them seminaries of sedition; but the keepers of them were sufficiently powerful to make him revoke the prohibition. The history of these houses would form a curious chapter in politics and literature, for they are associated with the earliest development of free political discussion, and with the greatest names in English literature. Among the oldest of them is the "Grecian," where Shakespeare and Rare Ben were frequent visitors; and hardly less ancient is "Wills," where Dryden held forth with pedantic vanity, and where the foundation was laid for that critical acumen which soon became a distinguishing feature in English literature. In the city, too, there was "Garraway's" where not only was tea first sold, but where, in Defoe's time, "foreign banguiers," and even ministers resorted to drink it. "Robins" and "Jonathans," and the "Cocoa-nut Tree," in St. James-street, were also famous, and had their distinguishing followers.

(To be continued.)

Proceedings of Institutions.

YORKSHIRE UNION OF MECHANICS' INSTITUTES.—LOCKWOOD'S WORKING MEN'S CLUB.—A meeting of the

members was held on Thursday, August 28th, to take into consideration the establishment of science classes in the club-house; Mr. Reuben Hirst, treasurer, occupied the chair. The scheme of the Department of Science and Art, and the pecuniary advantages given by the Government, were detailed and explained by Mr. Henry H. Sales; and after addresses by Mr. Shaw, Mr. Kenworthy, and others, it was unanimously resolved to take measures for the establishment of a class for the study of chemistry during the winter season.

EXAMINATION PAPERS, 1868.

(Continued from page 692.)

The following are the Examination Papers set in the various subjects at the Final Examination held in April last:—

CHEMISTRY.

THREE HOURS ALLOWED.

No candidate is allowed to answer more than three questions in each division.

FIRST DIVISION.

1. What weight of oxygen is contained in one gramme of potassic chlorate?
2. What volume of hydrogen would be obtained if all the oxygen were taken away from a cubic foot of steam?
3. How could you prove that gunpowder is a mixture of sulphur, carbon, and nitre?
4. Describe by equations the action of hydrochloric acid on the following compounds—viz., chalk, iron, and manganese (peroxide).
5. What are the chief impurities in common spring water? How are they detected?
6. How would you ascertain whether a given mineral contains silica?

SECOND DIVISION.

1. A silver coin is suspected to contain a little gold; how would you ascertain whether gold is present in it?
2. What is the commonest ore of lead? How is the metal obtained?
3. What reasons are there for attributing to alumina the formula Al_2O_3 ?
4. How is metallic zinc prepared? Give its characteristic reactions, and the formula for its crystallised sulphate.
5. How would you test for copper in a mixture containing other metals?
6. Name and describe the chief ores of iron.

THIRD DIVISION.

1. How would you ascertain whether a given sample of water contains organic matter in solution.
2. What are the chief proximate constituents of wheat flour? How would you separate them?
3. How would you ascertain the proportion of alcohol in a given sample of wine?
4. Describe and explain the process of etherification.
5. How can aniline be made from a benzoate?
6. How is acetone prepared? Give its empirical and its rational formula, and adduce proofs of the latter.

MINING AND METALLURGY.

THREE HOURS ALLOWED.

Six questions to be answered.

1. Name the various machines employed for grinding the ores of copper, lead, tin, and silver.
2. Which are the most important silver-producing countries in the world?
3. Describe Pattinson's process for desilverising lead.
4. How do you estimate the amount of gold contained in a given weight of auriferous quartz?
5. Describe the metallurgical treatment of zinc ores by what is called the Belgian process.

6. Describe the characteristic peculiarities of the Cornish pumping-engine.

7. What is the geological age of the gold-producing rocks of California?

8. What process would you commercially employ in order to ascertain the produce of copper of an ore containing less than 3 per cent of that metal?

9. Under what conditions is stream tin usually found, and wherein does it differ from tin ore obtained from mineral veins?

10. Describe the process of reducing poor copper ores to the state of matt, or regulus, by roasting in the open air, and fusing in a blast furnace.

11. How would you estimate the amount of tin contained in a specimen of gun-metal?

12. Describe the process of making iron by the Catalan forge.

BOTANY.

THREE HOURS ALLOWED.

The candidate is expected to answer correctly three questions in Section I. and six questions in Sections II. and III., including descriptions of at least two of the fresh specimens. Nos. 8, 9, and 10 each stand for an answer.

SECTION I.—STRUCTURE AND PHYSIOLOGY.

1. Define the following, and comment upon each as required:—

Radicls. What is meant by the terms *superior* and *inferior* applied to it?

Zoospores. What is their function?

Drupe. Give four examples.

2. A potato is planted weighing four ounces. In six months the produce of the tuber weighs, say four times as much. Whence is the addition in weight derived? And of what proximate and ultimate elements does it consist?

3. Explain the mode of growth of the *bark* of trees and the general characters which distinguish that of the Beech, Birch, and Elm respectively.

4. To what is the *green colour* of leaves due? In what functional contrast do the green organs stand to those of other colours?

5. What are *Stomates*? Where do they occur?

6. What are *Seeds*? Describe the structure of the seeds of the *Hawthorn* and *Wheat*.

SECTION II.—SYSTEMATIC AND ECONOMIC BOTANY.

1. Which Natural Orders furnish the following products? State the part of the plant affording each:—

Gum Arabic, Sago, Olive Oil, Indigo, Capers, Opium, Tamarinds.

2. State the distinctive characters of the three principal Orders of Vascular Cryptogams.

3. Describe the principal modifications of the *fruit* in British Cruciferae.

4. Enumerate all indigenous British *Coniferae*, and state how they differ.

5. Distinguish *Chenopodiaceae* from *Polygonaceae*.

6. What is meant by a *Natural System* of classification?

7. Name the Natural Orders to which the three plants marked A, B, and C respectively belong, *with reasons* for your opinion.

SECTION III.—DESCRIPTIVE BOTANY.

8, 9, and 10. Describe the three plants marked A, B, and C, noticing the various organs in their proper sequence.

(To be continued.)

SCIENCE INSTRUCTION IN CONNECTION WITH THE SCIENCE AND ART DEPARTMENT.

The following table gives the number of schools and students since the passing of the General Science Minute:—

Years.	Number of Schools.	Number under Instruction.
1860	9	500
1861	38	1,330
1862	70	2,543
1863	75	3,111
1864	91	4,666
1865	120	5,479
1866	153	6,835
1867	212	10,230

Each separate Institution, in which scientific instruction is given, is treated as a school, but the subjects taught and the number of classes in the different schools vary much. In some cases a school consists of but one class, and there is only one subject taught, in others there are as many as nine and ten classes in different subjects. The total number of classes in the 212 schools was about 560. 4,520 students came up for examination in May from these classes which are under certificated teachers, besides about 400 self-taught students and pupils of classes not under certificated teachers. The results, as compared with the previous year, are given below:—

Years.	Number examined.	Number of Papers worked.	Number of Papers passed.	Prizes.
1865	2,633	4,592	3,371	1,482
1866	2,980	5,466	3,562	2,071
1867	4,430	8,213	6,013	3,453

At the examinations for seafaring men held in March, September, and December, about 40 persons were examined, in addition to the above.

The May examinations were held at 167 centres, 152 provincial and 15 metropolitan. At these examinations the Royal exhibitions to the Royal School of Mines in Jermyn-street, and College of Science in Dublin, were competed for as in former years. Four were thus awarded to the Royal School of Mines, and five to the Royal College of Science in Dublin.

The payment to teachers for the year 1867 amounted to £7,976, being at the rate of 15s. 7d. for each person under instruction. The previous year this payment amounted to about 14s. 6d. The number of teachers paid was 194, the payments varying from £1 to £220, the average being about £14 per teacher. Grants were also made towards the purchase of apparatus, diagrams, and examples, amounting in the year to £167 19s. 0½d., being an increase on the year before, 1866, when they amounted to £142 10s. 3½d.

At the commencement of this year, 1868, there were 283 science schools and institutions in which science instruction was being given under certificated teachers, 199 in England, 11 in Scotland, and 73 in Ireland. These had 789 classes, and were teaching 11,606 students. This is an increase of 76 schools and 3,314 students over last year, and is irrespective of two navigation schools, which do not send up pupils for examination, and, therefore, receive no payments on results.

The examination in November, 1866, was the last special annual examination for teachers' certificates. By the minute of 12th February, 1867, all persons who obtain a first or second class at the annual May examinations of the Department are qualified, if they teach, to earn payments on results. As the May examinations are held all over the kingdom, teachers are enabled to qualify themselves with much greater facility than when they were required to attend a special examination in London, Dublin, Edinburgh, or Manchester. The abolition of this special examination is also a great saving of expense to the candidates and to the Department.—(From the "Fifteenth Annual Report.")

INDIAN ARCHITECTURE.

Scarcely two years have elapsed since Mr. Fergusson, in an able paper, brought this new and comparatively unknown subject before the members of the Society. The seeds sown on that occasion by the paper, and the discussion which followed, appear to have borne fruit both in India and at home.

About this time, a correspondence on the subject of surveying the architectural remains in India, and taking casts of some of the typical monuments for the information of this country, seems to have been commenced between the Science and Art Department and the Secretary of State for India, and between the latter and the Governor-General of India. This correspondence has recently been laid before Parliament in the Appendix to the 15th Report of the Department of Science and Art. The Department expressed a wish to have a complete representation of Indian architecture for the South Kensington Museum, and transmitted the following memorandum in illustration of its desire:—

CLASSIFICATION OF INDIAN ARCHITECTURE.

(From Fergusson's "Dictionary of Architecture.")

BUDDHIST ARCHITECTURE.

Division of Subject—Topes, Sanchi—Temples, Karli—Monasteries, Ajunta—Ornamentation of caves.

Birth of Gautama Buddha, 623 B.C.

Death of Gautama Buddha, and first convocation held, 543 B.C.

Chandragupta, contemporary of Alexander, 325 B.C.

Asoka, third convocation held; Buddhism made the religion of state. Lâts erected. Earliest monuments and inscriptions in India, 250 B.C.

Dasaratha, his grandson. Earliest caves in Behar, about 200 B.C.

Cuttack caves, from 200 B.C. to about the Christian era.

Topes at Bhilsa, 2nd century B.C., to 2nd or 3rd A.D.

Vicramaditya buildings at Oujein, 56 B.C.

Salivahana cave at Karli, 79 A.D.

Topes at Manikyala, 1st century B.C. to 3rd or 4th A.D.

Topes in Afghanistan, 1st century A.D. to 5th or 6th.

Caves in Ajunta, 1st century A.D. to 10th or 11th.

Caves at Ellora, 5th century A.D. to 8th or 9th.

Topes at Sarnath, 6th to 9th century A.D.

CEYLON.

Description of ruins at Anuradhapoora—Ruins at Mehenetele—Great monastery and sacred tree at Anuradhapoora—Ruins at Pollonaruwa.

Devenampiatissa, contemporary with Asoka, 250 B.C.

Introduction of Buddhism to Ceylon. Building of Thupamya Tope, and that at Mehenetele, &c., 250 B.C.

Dootogamoni. Building of Runwelle Tope, and Maha Lowa Paya Monastery, 161 B.C.

Walagambahu builds Abayagiri, 104 B.C.

Abha Sena builds Lanka Ramaya, 231 A.D.

Maha Sena builds Jetawana Tope, 275 A.D.

Pandu: invasion from Cashmeer, 434 A.D.

Aggrabodhi changes capital to Pollonaruwa, 769 A.D.

Wejyabahoo, capital Dambadinia, 1235 A.D.

BURMAH.

Forms of Burmese buildings—Dagobas at Khomadoo—Pegue—Rangoon, &c.—Monasteries.

Rahamam, son of Asoka, begins to reign at Prome about 243 B.C.

Samundri Prome era established 76 A.D.

Samudda Raja begins to reign at Pagan, 107 A.D.

Buddhagosa visits Ceylon, 386 A.D.

Panya becomes the capital, 1300 A.D.

Pagan destroyed, 1356 A.D.

Panya and Chitkaing destroyed, and Ava becomes the capital, 1364 A.D.

Alompra in Monchabo, 1752 A.D.

JAINA.

Definition of Jainism—Temples on Mount Abu—Origin of Domes—Domes of Jains and Buddhists—Temples of Somnath—Chandravati and Sadree—Towers at Chittore.

Parswanath, 23rd Tirthankir, about 800 B.C.

Mahavira, 24th and last Tirthankir (contemporary and preceptor of Gautama Buddha), died about 600 B.C.

Amogaversha, King of Conjeveram; revival of Jaina religion by Jina Sena Acharya, 9th century A.D.

Munja of Ougein, 933 A.D.

Bhoja of Ougein, about 1000 A.D.

Kumara Pala of Gujerat converted, 1174 A.D.

Temples on Mount Abu, 1032 to 1231 A.D.

Khombo Rana, of Merwar, built temple at Sadree, and pillar at Chittore, 1418 A.D.

Udaya Sinh, third sack of Chittore by Akbar, 1580 A.D.

SOUTHERN HINDU.

Historical notices—Form of Temples—Porches of Temples—Gateways—Pillared Hall—Temples at Seringham, Trivalur, Tinnevely, &c.—Kylas at Ellora—Construction of Rock-cut Temples—Modern Hindu style in the South.

Kula Sechara founds Madura about the Christian era. Vamsa Sechara rebuilds it, 9th century, founds the College of Madura.

Vikrama Chola—Rise of Cholan supremacy; capital, Tanjore, 827 A.D.

Vira Chola builds temple at Chillumbrum; Ari Vari Deva, his grandson, completes temple at Chillumbrum, 1004 A.D.

Kylas at Ellora, excavated by Cholan princes, about 1000 A.D.

Rise of Chalukya power, 1058 A.D.

Trimul Naik rebuilds Madura, 1621 A.D.

NORTHERN HINDU STYLES.

Cuttack Temples—Temples in Upper India—Modern Temples at Bindrabun and Benares—Mixed Hindu style—Tombs—Palaces—Ghâts—Bunds—Wells, &c.

Invasion of Cuttack by strangers coming by sea, 318 A.D.

Lelat Indra Kesari builds temple at Bobaneswar, 657 A.D.

Ananga Bhim Deo builds temple at Juggernath, 1174 A.D.

Indra-dyumna excavates caves at Ellora, 1176 A.D.

Raja Nursing Deo builds Black Pagoda at Kanaruc, 1236 A.D.

Maun Sing builds temple at Bindrabun, 1592 A.D.

Amara Sing rebuilds Oudipore, 1596 A.D.

Jaya Sing builds Jeypore, 1698 A.D.

Sooraj Mull builds palace at Deeg, 1750 A.D.

On July 30th, 1867, the Department expressed a readiness to share with the Indian Government the expenses of taking plans, photographs, and casts of the finest monuments, and suggested a joint committee of action. On the 6th December, 1867, the India Office stated that steps had been taken in India to form an organization for collecting information, &c., and on 7th May, 1868, transmitted a copy of the following document:—

"EXTRACT FROM THE PROCEEDINGS OF THE GOVERNMENT OF INDIA IN THE HOME DEPARTMENT (PUBLIC) UNDER DATE THE 24th FEBRUARY, 1868.

"Read the circular addressed to the several local governments * and administrations † noted below, dated the 29th August, 1867, requesting their attention to the subject of conserving ancient architectural structures or remains, and other works of art in India, and desiring

* Madras, Bombay, Bengal, N. W. Provinces, Punjab.

† Chief Commissioner, Oude; Chief Commissioner, Central Provinces; Chief Commissioner, British Burmah; Resident at Hyderabad; Commissioner, Mysore.

the submission of lists of all such structures, and a report of the measures, if any, adopted in preserving from time to time all such objects of architectural interest within the limits of the several presidencies and provinces.

"Read the despatch from Her Majesty's Secretary of State, No. 165, dated the 9th December, 1867, communicating certain suggestions with reference to the proceedings above mentioned, reported to him in the despatch of the Government in India, No. 163, dated the 6th September, 1867.

RESOLUTION.

"On further consideration of this important subject, his Excellency the Governor-General in Council is led to form the opinion that the first step towards a satisfactory attainment of the objects in view is to require the insertion, in every annual Administration Report, of a separate Chapter on Archæology, under which heading the local governments and administrations should be requested to notice the condition of all works of art mentioned in the lists required of them under the instructions contained in the circular of the 29th August last.

"2. Petty repairs, or measures which may be necessary for the preservation of these structures, should be dealt with also by the local governments; operations on any large scale being referred for consideration to the Department of Public Works.

"3. But in the matter of obtaining casts and photographs of the most important works of ancient architecture in India, the Governor-General in Council considers that it will be best to proceed in the first instance experimentally.

"4. The process of preparing casts is not difficult, and information obtained from Mr. H. H. Locke, the principal of the School of Art in Calcutta, confirms the belief that men can easily and speedily be instructed in the art, who already possess some slight elementary knowledge as modellers or even as potters of a superior class. Probably fair modellers may be procured at Lucknow for the work in the Upper Provinces.

"5. The work of training may commence during the ensuing hot season and rains in the several local schools of art, and be confined to a *set of men* who should be employed in modelling at first the fragmentary remains of ancient art to be found in the local museums, some of which are worthy of being so modelled and sent home.

"6. A single party for each province should thus be trained for the work; and, when fully trained, employed during the cold weather, under the general superintendence of some one qualified for the task, in taking a complete set of models of one or more large buildings.

"7. A party of 10 or 12, for example, would, in the opinion of his Excellency in Council, be probably able to make casts of all those portions of such a building as the Sanchi Tope as may be desirable to reproduce. Each party should be placed under the immediate superintendence of some intelligent subordinate of the Public Works Department, who should be solely employed on the duty, and should reside on the spot. It will be his immediate province to see that the modellers carry out the orders of the superintending officer.

"8. The modellers should prepare what are called "waste moulds," and then "piece moulds" on the spot; these last should be made, if possible, in a convenient form for removal, and from them any number of casts can be prepared.

"9. These piece moulds, or casts, as may be most convenient, should be transmitted to the seat of Government, or other place selected as the head-quarters of the general superintendent, and from these the requisite number of casts will be prepared and sent to Europe.

"10. Whilst the modellers were engaged at work, the Public Works Department subordinate should also be employed in preparing accurate plans and measurements of the entire building. Arrangements could likewise be made for procuring photographs of it from such points of view as may be necessary, and which should be indi-

cated by the officer superintending the operations. A written description should also be procured from some competent person for publication in England, with illustrations from the plans and photographs of such of the details (which the casts would give) as may be thought expedient. One or two such memoirs for each party during the year would, in all probability, be sufficient for the present.

"11. As regards the cost of these proceedings, they may be estimated, by a rough calculation for each party for the first year, as follows:—

Training 12 men for eight months at Rs. 30 each	2,880	0	0
Pay while in the field, say at Rs. 60, for four months	2,880	0	0
Pay of a Public Works Department subordinate to supervise, say at Rs. 300, for four months	1,200	0	0
	6,960	0	0
Charges for photographing, say	*1,000	0	0
" " gypsum, or plaster of Paris say	2,000	0	0
" on account of contingencies	2,000	0	0
Total	11,960	0	0

"12. The officer superintending will also be paid for his visitation and superintendence, which would probably raise the cost to about Rs. 13,000 for each party.

"13. His Excellency in Council would propose for the present to have only four parties working, viz., one party in Madras, one in Bombay, one for Lower Bengal and Behar, and another for the North-western and Central provinces at a cost of Rs. 52,000 per annum.

"14. It is suggested that the local governments might allow the experiments to be carried on at first under the charge of the principals of the Schools of Art and Design at the Presidencies, who would train the men, and then be deputed to take them out to work on the building which may be selected for their labours. They should visit their parties once or twice during the season. In the North-western Provinces the services of Lieutenant Cole, R.E., might, with advantage, be secured, should he be willing to undertake the duty, and if the Department of Public Works will allow him to undertake it. The selection of the work or works to be experimented upon should be left to the local governments. In the Upper Provinces the Sanchi Tope and others in its vicinity, and one of the Orissa Temples in Bengal, would, perhaps, be fit subjects. Much assistance in the execution of this project may be obtained from local officers interested in archæology, and regard may conveniently be had to this point in the selecting the locality of the experiment.

"15. Some difficulties may be encountered in procuring a sufficient supply of plaster of Paris. It has been ascertained that the School of Art in Calcutta has found itself compelled already specially to import gypsum from Europe, but gypsum of good quality exists in various parts of India; and in Madras, it is believed that Dr. Hunter already uses a coarse kind, and supplies it far more cheaply than if it were imported from Europe.

"16. The Governor-General in Council would be glad if the local governments directed their attention to this point."

ORDER.

"Ordered, that a copy of the foregoing resolution, and of the despatch from her Majesty's Secretary of State, No. 165, dated the 9th December, 1867, and enclosures, be forwarded to the local governments† and administrations‡ mentioned below.

"Also, that a copy of the resolution, and of the Secretary

* This is for a professional artist.

† Madras, Bombay, Bengal, N. W. Provinces, Punjab.

‡ Chief Commissioner, Oude; Chief Commissioner, Central Provinces; Chief Commissioner, British Burmah; Commissioner of Coorg.

of State's despatch referred to, be forwarded to the Foreign Department, for communication to the Commissioner of Mysore and the Resident at Hyderabad.

"Further, that a copy of the resolution, and of the despatch from the Secretary of State mentioned therein, be forwarded to the Financial Department.

"Ordered also, that a copy be sent to the Department of Public Works.

"(True extract.)

"(Signed) E. C. BAYLEY,

"Secretary to the Government of India."

If this organisation work effectively, there appears good reason to expect that the monuments of India will be preserved from ruin, and that illustrations of the most important will soon be seen in this country.

Fine Arts.

SPECIAL COLLECTION OF DESIGNS, BY THE GREAT MASTERS, IN THE LOUVRE.—Attention has recently been called to a fact connected with the Louvre, which will certainly be new to the great majority of visitors to Paris, as it is so even to the natives. There exists, in the upper floor of the museum, a collection of forty-two of the most precious specimens of sketches and drawings by the old masters, belonging to the Louvre, each one being protected by a box frame of oak, furnished with shutters like a triptych. The collection includes thirteen by Poussin, nine by Raphael, three each by Michael Angelo and Titian, two by Perugino, one each by Fra Bartholomeo, Albert Durer, Verrochio, Andrea Solaris, Francia, Perino del Vaga, Leonardo da Vinci, with one belonging to the Florentine school, and another to the Venetian or Lombardian school of the end of the fifteenth century, artists' names unknown. This remarkable collection is open to the public every Saturday, from two to four o'clock.

Manufactures.

CHEMICAL MANUFACTURES IN ITALY.—In Italy sulphuric acid is manufactured principally at Turin, Milan, Venice, Rimini, Bologna, Naples, and Palermo, and the annual produce may be estimated at 75,000 quintals, to the value of 750,000frs. (£30,000). Upwards of 7,000 quintals of sulphuric acid are annually employed at an establishment at Castellamare, near Naples, for the manufacture of a madder dye. At this manufactory, from 400,000 to 500,000 quintals of madder are used, and the annual production of dye may be estimated at 200,000 quintals. The manufacture of nitric acid is carried on on a much smaller scale than that of sulphuric, being about 3,000 quintals, to the value of 300,000frs. (£12,000). The production of muriatic acid is estimated at 2,300 quintals, to the value of 108,000frs. (£4,320). Acetic, arsenic, and benzoic acids are manufactured in very small quantities. Pyroligneous acid is distilled from wood, at Florence and at Intra, on the Lago-Maggiore. Citric acid forms an important branch of manufacture in the southern provinces, and, especially in Sicily, an impure citric acid is obtained by inspissating the expressed juice of the lemon, in the form of a black fluid, like thin treacle. There are no returns of the quantity produced, but in the establishment of Signor Fonzio, at Palermo, 22,000 litres of juice are extracted from 4,000,000 of lemons annually. The exports of this fluid are estimated at 1,938,434 kils., to the value of 407,000frs. (£16,280). The rind of the lemon is removed, for the sake of its essential oil, and, in 1865, 305,251 kils. were exported, to the value of 7,000,000frs. (£280,000). In Sicily there are two manufactories of citrate of lime, which produce from 1,500 to 2,000 kils. per annum. The great

supply of boracic acid is derived from the boracic acid lagoons of Tuscany, between Pomarance and Massa. Before the discovery of this acid, in the time of the Grand Duke Leopold I., by the chemist Hoefer, the fetid odour developed by the sulphuretted hydrogen gas, and the disruptions of the ground occasioned by the appearance of new *soffioni*, or vents of vapour, had made the natives regard them as a diabolic scourge, which they sought to remove by priestly exorcisms; but since science has explained the phenomena, the *funachi* have become a source of public prosperity. In 1818 a French company undertook various works for the purpose of obtaining boracic acid. For this purpose one or more *soffioni* were surrounded with low walls, so as to form a sort of reservoir, varying from 5 to 15 metres in diameter, according to the number and size of the *soffioni*. The vapours, containing a very minute quantity of boracic acid, which issue from these *soffioni*, keep the waters on the reservoirs, or *lagoni*, always at a boiling temperature; hence, after impregnation for 20 to 30 hours, by the streams pouring through the liquid reservoir, the waters are drawn off into a second reservoir, situated at a slightly lower level, to suffer a second impregnation. Thence they are drawn into a third, and so on, till they reach the lowest receptacle. In this passage they get charged with about half per cent. of boracic acid. They are then concentrated in leaden reservoirs by the heat of the vapours themselves. The liquid, after having filled the first compartment, is run very gradually into the second, then into a third, and successively into the last, when it reaches such a state of concentration that it deposits the crystallised acid; the workmen remove it immediately by means of wooden scrapers. This mode of gradual concentration is very ingenious, and requires so few hands that it may almost be said that the acid is obtained without expense. The manner in which the boracic acid is produced in the *soffioni* has not yet been explained, for in collecting these vapours no trace of the acid is found. From boracic acid, borax, extremely refined, is manufactured. The use of borax, in former times, was limited to the purpose of soldering and working of metals, or to the manufacture of enamels—it is now applied for making glazes for porcelain, pottery, china, &c. It is surprising that these natural advantages should have remained unproductive for so many ages, and that it should have been reserved for the skill of Count Larderel, of Monte Cerboli, who took the management of these works in 1826. Although the well-known manufacture is not recent, still, the bold originality of its first conception, the perseverance and extraordinary resources displayed in the successful establishment, and the value of the product which it supplies, will always place the operations of Signor Larderel amongst the highest achievements of the useful arts. The vapour issuing from the volcanic soil is condensed, and the minute proportion of boracic acid which it contains is recovered by evaporation in a district without fuel, and by the aid of the volcanic vapour itself as a source of heat. According to the estimate of the *ingenieur des mines*, the works of Signor Larderel produce 6,000 quintals per annum, but according to other sources, which we believe to be more correct, is 20,000 kils. The total production of boracic acid in Italy is estimated at 18,055 quintals per annum, to the value of 1,445,890frs. (£57,836). The exports were as follows:—

Years.	Quantity.	Value.
	kils.	frs.
1862	1,206,855	6,155,000
1863	1,293,968	6,599,000
Average ..	1,250,411	6,377,000=£255,080.

In 1863, 962,444 kils. were exported to England, and 331,624 kils. to America. Soda and potash in Italy are

chiefly obtained from the vegetable kingdom, and in Central and Southern Italy the production of these alkalis, obtained by the combustion of certain plants, is estimated at 15,464 quintals. The following is the average of three years:—

Years.	IMPORTS.		EXPORTS.	
	Potash.	Soda.	Potash.	Soda.
1863	quintals. 3,652	quintals. 50,516	quintals. 2,760	quintals. 6,024
1864	12,327	46,036	6,405	1,103
1865	6,118	48,284	1,768	4,119
Average ..	7,966	48,270	3,644	3,748

The principal manufacture of white lead (carbonate of lead) is carried on at Genoa and Leghorn, and the total production may be estimated at 16,400 quintals, to the value of 1,640,000frs. (£65,600) per annum. Zinc-white is only manufactured at Venice, by Sig. Bigaglia, who produces yearly 140,000 kils., to the value of 91,000frs. (£3,640). Alum is found principally at Montioni, in Tuscany, in large irregular masses. The sorted pieces are roasted, or calcined, by which operation the hydrate of alumina associated with the sulphate of alumina loses its water and its affinity for alum. It becomes therefore free, and during the subsequent exposure to the weather the stone gets disintegrated, and the alum becomes soluble in water. The calcined alum stones piled in heaps, from two to three feet in height, are kept continually moist by sprinkling them with water. As the water combines with the alum the stones crumble down, and form eventually a pasty mass, which must be lixivated with warm water, and allowed to settle in a large tank. The clear liquor, being drawn off, is evaporated, and then crystallised. A second crystallisation finishes the process, and furnishes a marketable alum. The following is the quantity and value of the products of this industry at Montioni:—

Crystallised alum	68,356 kils.
Value	15,038 francs.
Number of workmen employed	35
Days employed	190
Wages	8,655 francs.

The production of sulphates of iron, copper, and zinc, are very limited, and are chiefly manufactured in Lombardy, Piedmont, Tuscany, and Naples, and are estimated at 16,000 quintals per annum. In 1863, the imports of these sulphates were 6,644 quintals; in 1864, 6,979 quintals; and in 1865, amounted to 10,972 quintals, to the value of 382,000frs. (£15,280). The manufacture of alum from the artificial sulphate of alumina is carried on at Bagnoli, near Naples, where many thousand quintals of alum are produced annually, and are used chiefly by the various paper-mills in the Neapolitan provinces. The production of bitartrate of potash, or cream of tartar, is estimated at 30,000 quintals, to the value of 2,600,000 francs per annum (£104,000); and the average exports of this product exceed 14,000 quintals, as will be seen by following table:—

Exports.

Years.	Quantity.	Value.
	quintals.	francs.
1863	11,797	1,061,000
1864	18,084	1,617,000
1865	13,017	1,171,000
Average	14,299	1,286,000

The carbonate and sulphate of magnesia (Epsom salts) are prepared in comparatively small quantities, namely, about 4,000 quintals, which are sold in Italy at

from 120 to 125 francs per quintal. Chloride of lime is manufactured, on a small scale, at Turin, Pisa, Bologna, and Salerno. Corrosive sublimate and red oxide of mercury are manufactured at Milan; the quantity of mercury used for this manufacture is from 1,500 to 2,000 kils. About half the produce is exported to Russia, at the price of 6·50frs. per kilo. Another important manufacture of this product, that of Signor Zecchini, at Venice, produces upwards of 19,800 kils. yearly. Salts of ammonia are chiefly produced in towns where there are gas-works. Liquid ammonia is prepared from the saturated liquor drawn from the purifying vessels at the gas-works at Turin, Milan, Venice, Florence, Rome, and Naples. Litharge is chiefly manufactured in the Romagna, on a scale not only to supply the wants of local industry, but it also forms an important article of export. The manufacture at Rimini exports about 10,706 kils. yearly of this substance. A trifling quantity is also made in Piedmont, Lombardy, Venice, Tuscany, and the Neapolitan provinces.

Commerce.

CocOA.—The annual production of the crop of this plant (*Erythroxylon coca*), in Bolivia, is officially estimated at 600,000 anobas of 25lbs. each. It grows in abundance on the surface of the yungas of the department of La Paz. The peculiar qualities of this plant are well known. The Indians, of whom there are about a quarter of a million in the states, chew it continually, as it has the reputation of staying hunger, allaying thirst, and doing away with the necessity for sleep. It is the most powerful of tonics, if half the virtues attributed to it are true. In France, a tonic wine and an elixir are now made from the leaves, and sold. This plant is also cultivated in vast tracts of Peru, known under the name of cocalis.

THE WATCH TRADE IN SWITZERLAND.—According to the latest statistics, the number of watches manufactured annually in Switzerland amount to upwards of 1,200,000, and may be valued at from 55 to 60 millions of francs. The number of workpeople employed in this branch of industry is about 60,000.

Publications Issued.

THE SLIDE VALVE PRACTICALLY CONSIDERED. By N. P. Burgh, Engineer. Second Edition. (*E. and F. N. Spon.*)—This work has been entirely re-written. Chapter I. contains the proportions for single ported slide valves, which are treated at some length. The formulæ are put forth in a simple and practical style, for the purpose of general application. Chapter II. contains particulars of exhaust relief, and double and treble ported side valves; the proportions investigated of these are under all circumstances, noticing in particular the width of the supply-opening caused by the valve on the cylinder facing, width of the large bar, and amount of opening for the main exhaust-port. The examples described in these chapters are taken from actual construction, the proportions therefore form a guide for future practice. The mechanical matters that relate to the outside lap of the slide valve are noticed under the following questions:—The variation in the speed of the piston and crank-pin; relation of the travel of the valve to the eccentric circle; and delineation of the paths of the crank-pin and centre of eccentric. In chapter IV., the geometrical demonstrations to produce the outside lap of the slide valve, for any point of off-cut, &c., have been fully explained. Of foreign authors, Dr. Zeuner, a German, and Messrs. Long and Buel, Americans, have been referred to and quoted. The English authorities cited are Professor Rankine and Messrs. Watt. After that, Mr. Burgh has dealt with the matter,

investigating and explaining the actual meaning and practical value of the versed sines of the crank and eccentric arcs, their application and reference, and the reason why the length of the eccentric rod must bear a distinct relation to the length of the main connecting-rod, and the position of the latter to that of the slide valve. The application of the slide valve as an expansion-valve has been explained in chapter V. Chapter VI. is an explanation of the proportions of modern slide valves in actual practice by the firms of Messrs. Penn, Maudslay, Rennie, Ravenhill, Watt, Napier, Dudgeon, Winter, Spencer, &c. Single, double, and treble ported slide valves are described; also valves for compound engines, and expansion slide valves, making in all eleven examples, fully illustrated, and all the main dimensions given. In chapter VII. the most modern types of packing rings, and their means of adjustment for slide valves, are explained and completely illustrated. As a conclusion, chapter VIII. treats of general observations, taking up certain matters and disposing of them as far as practice will admit. The number of illustrations in the first edition was only eighteen; this edition has thirty eight, with thirty-seven pages of additional descriptive matter; and thus the entire subject has not only been extended in explanation, but in illustration also, up to the practice of this date.

Notes.

FRENCH VIEW OF ENGLISH AGRICULTURE.—Few occurrences in England have called forth from our neighbours in France such unanimous admiration as the late meeting of the Royal Agricultural Society of England, held at Leicester; all who visited it seem to have been delighted, not only with the show itself, but also with the manner in which they were received by the agriculturists of England. Amongst the best notices that have appeared, is that by M. F. R. De Tréhonnais, a gentleman who holds an appointment under the Imperial Government in Algeria, and who profited by a holiday in Europe to visit the Leicester meeting and report upon it in M. J. A. Barral's excellent *Journal de l'Agriculture*. M. De Tréhonnais does not hesitate to run the risk of being considered, as he says, "more English than the English themselves," but says boldly that it is well to hold up before his countrymen "the wondrous picture of English agriculture, which is far, very far, in advance of our own, in order to excite fruitful emulation, and show the true road to progress." M. De Tréhonnais sketches the history of agricultural progress in England, in a manner which shows him master of his subject. Speaking of his journey to Leicester, he says that the road which leads from London to that town passes through one of the best cultivated countries in the world; the fields, it is true, are small, but the hedges which bound them are neat and well clipped, and the crops are exquisitely clean. The unusual drought had destroyed all the green crops, but the wheat was magnificent, and the heavy sheaves already cut promised an abundant harvest. M. Tréhonnais gives a concise and vivid sketch of the various races of animals bred and fed in England, showing an intimacy with our agriculture which is explained by his assertion that he has been for more than twenty years a member of the Royal Society of Agriculture. His admiration of the horses is as great as for the horned cattle and other animals, and he declares his conviction that it would be impossible, in any other country, to collect so many horses, exhibiting so many good qualities, at once as were to be seen at the Leicester gathering. Summing up his observations, he declares his conviction that the show in question was the best ever seen in England; never, he thinks, did the various classes of animals exhibit so many really useful qualities. M. De Tréhonnais promises to follow up his notice of the live stock at Leicester with another

on the agricultural implements shown there, and on the experiments made in steam cultivation.

PECULIARITIES OF THE SEASON IN FRANCE.—The excessive heat and dryness of the summer caused the trees to assume an autumnal garb in the month of July, and in many cases to be denuded of leaves; the larger trees remain leafless, but the younger, and particularly the limes, have been, in many places, covered with new leaves since the heavy falls of rain, which arrived at the beginning of August. Another proof of the exceptional character of the weather lies in the early period of the commencement of the vintage; many of the proprietors in the neighbourhood of Nîmes have already begun to get their grapes in, a fortnight before the usual time even for early seasons.

EXHIBITION IN CHILI.—An agricultural exhibition is to be held next year in Chili, and is to be opened on the 1st of April. This will be the first exhibition that has been held in the republic of South America.

UTILIZATION OF SEWAGE.—A series of experiments have been made at Clichy on the Seine, near the mouth of the great collector of Asnières, with the view to the solution of the important question of the application of sewage water, with regard to sanitary and agricultural considerations. The experiments include the separation of the solid matter by chemical means, and the direct application of sewage water without any previous preparation. According to the report made by M. Mille, the engineer entrusted with the experiments, the chemical purification is obtained by means of sulphate of alumina, which precipitates the solid matter held in solution. The cost of this process is said to amount only to two centimes, or less than a farthing, per ton, and the value of the solid manure is given at nineteen francs (fifteen shillings) per ton. The direct application of unprepared sewage water by means of irrigation is reported to have yielded excellent results last year; thus treated, Indian corn gave a crop equal to nearly four tons and a half per acre, while crops of beetroot exceeded twelve tons per acre. The experiment with pumpkins was also eminently successful. A jury appointed to taste the different products came to the decision that the increased size did not seem to have injured the flavour or other qualities, and that there was no evidence of taste or smell of the system adopted. It should be stated that the quantity of sewage water used in these cases was not greater than that ordinarily supplied by market gardeners to their lands after they have been manured. The experiments commenced at Clichy are to be pursued upon a much larger scale on the plain of Gennevilliers.

Correspondence.

WORKMEN'S HOLIDAYS.—SIR,—In answer to your request for information on workmen's holidays, we forward you a few remarks on the subject, and on others that seem to grow out of it, or have some connection with it. We have, for some time, encouraged our men to take their holidays at one time rather than piece-meal. In order to carry out the plan with success, it is almost necessary (in order to avoid delays and losses) to organise a manufacture, and convert it, as far as possible, into a smooth-working system. We find the most convenient time to be at the end of the London season; the time would probably vary in other trades. Only among men of sober habits do we think it practicable. We virtually prohibit over-time, as we consider it tends to bodily and mental exhaustion, and so tends to the use of stimulants to restore the over-taxed energies. To promote regularity, and prevent waste of time and materials, mistakes and alterations, we have printed general directions for carrying on our manufacture; among them is one that workmen should give due notice to the foreman before absenting themselves, in order that arrangements may be made

to prevent inconvenience by reason of their absence. During the holidays taken by the men it seems very usual for them to visit their friends in the country, taking advantage of the excursion trains that run during the autumn. About 15 years ago, one of our apprentices (a very well behaved and intelligent young man) visited Paris on his own account, paying his expenses out of his savings. We doubt if it would be a real benefit for employers to give the holiday and pay wages as if they had the equivalent labour; if done for one (unless for some special reason) it must be done for all, or jealousy and heartburning would arise. There is a certain sweetness in enjoying leisure and change of scene, the fruit of one's industry and frugality; if obtained as a dole from an employer, it would come without so much moral training and self-restraint. We think that if periodical visits to foreign countries could be arranged for working men of intelligence above their fellows, to be paid for partly by their own savings and partly as a grant from some public body, as a reward for talent and good conduct, much good would result; they would be looked on as travelling scholarships, and be highly esteemed by the artisan class. These rewards would probably fall to the lot of those who in their earlier years had gained prizes at the Society of Arts Examinations; in fact, it would be very desirable to encourage these young men, after they have become workmen, to look forward to such further distinction; it would afford that opening to promotion that is so valued by the highest class of artisans at the present day. If some arrangements could be made, through the British embassies and consulates in foreign states, to procure the admission of travelling workmen to the most celebrated manufactories in foreign countries, it would tend much to the benefit such persons would receive, on visiting a foreign country for the first time, and enable them to take full advantage of their journey. Upwards of thirty years ago, when the late Duke of Cumberland became King of Hanover, he found the art of carriage-building in a very backward state in his new country; he, therefore, from time to time, sent over picked men to London and Paris, to improve themselves in their art. However, the laws relating to trade and manufacture in Hanover imposed so many restrictions that no great benefit resulted from the steps then taken; as in all countries, if trade and manufactures are to be fully developed, they must be free.—We are, &c., HOOPER and Co., per GEORGE HOOPER, Juror, Class 61, Paris Exhibition of 1867.

113, Victoria-street, London, S.W.

Patents.

From Commissioners of Patents' Journal, August 28.

GRANTS OF PROVISIONAL PROTECTION.

Anchors, &c.—2532—R. Saunders.
Boilers—2580—J. Landless.
Boilers, indicators for—2497—A. V. Newton.
Boots, &c., protecting the side-springs of—2519—R. H. Southall and W. Hallam.
Clocks, electric—2523—R. C. Rapier.
Coal, grinding, &c.—2539—T. R. Crampton.
Cocks or valves—2526—W. Payne.
Cog wheels, cutting wooden cogs of—2543—C. Evotte.
Colouring matters, brown—2548—C. D. Abel.
Cornices, &c.—2504—H., T., and G. Moore.
Explosive compounds—2542—W. Shaen.
Eyelets, machine for making—2494—B. Hunt.
Fans—2496—W. W. Hughes.
Fire-arms, &c., breech-loading—2534—I. M. Milbank.
Fog alarm, to produce audible signals—2564—W. E. Newton.
Food, preparing for horses, &c.—2428—J. Scott.
Forks and spoons combined—2470—G. W. Maddick.
Furnaces—2517—C. D. J. Seitz.
Fusee boxes—2290—J. M. Hector.
Grain, decorticating—2536—H. Steffanson and J. Hadley.
Grain, hulling—2526—G. A. Buchholz.
Head-dress, portable—2335—C. Ritchie.
Hydraulic apparatus for watering streets, &c.—2510—E. P. G. Headly.
Indigo, preparing—2541—H. B. Biako.

Iron and steel—2511—D. Hill, J. Richardson, G. N. Duck, C. G. Johnson, and W. F. Masterman.
Iron and steel, coating with gold, &c.—2545—J. B. Thompson.
Iron and steel, rolling—2501—J. Brown.
Iron or steel scraps, utilising—2514—J. Thompson.
Iron, &c., treating—2540—H. K. York.
Lace, &c., ornamenting—2522—J. Cleaver.
Lathes, &c.—2551—R. Robinson and G. D. Edmeston.
Liquids, measuring—2512—J. Winsborrow.
Looms—2537—J. Holding.
Looms—2509—J. R. Croskey.
Metallic ropes—2516—H. H. Henson.
Molasses, drying, &c.—2558—W. B. Espeut.
Motive-power, increasing—2403—J. Ratcliffe.
Paddle wheels—2291—J. J. Aston.
Paper bags—2493—T. Corfield.
Paper, card-board, &c., manufacturing—2515—J. Broad.
Paper-making machines, rollers for—2508—J. McFarlane.
Pencils for marking on linen, &c.—2550—J. Hickisson.
Photographic frames—2528—W. E. Newton.
Postal sample bags or envelopes—2521—H. Lunn.
Pottery kilns, &c.—2554—H. Y. D. Scott.
Printing machinery—2503—J. Salmon.
Printing surfaces—2507—A. Argamakoff.
Printing surfaces, raised—2498—D. Fruwirth and A. Hawkins.
Railways—2506—J. H. Johnson.
Railways, rolling stock, &c.—2531—W. Thorold.
Regulators, self-acting, for supplying fluids at high pressure, &c.—2426—C. Geoghegan.
Resins, treating—2489—F. Walton.
Seal-skin cloths, ornamenting—2520—H., J. W., & R. E. Dewhurst.
Sewing machine needles—2566—W. Edwards.
Sewing machines—2568—G. F. Bradbury and T. Chadwick.
Shafts, &c., regulating—2499—R. Robinson.
Ships' bottoms, &c., preventing the fouling of—2529—R. Sim.
Ships' propellers—2502—A. M. Clark.
Silk-combing machinery, &c.—2546—W. E. Newton.
Size, manufacturing—2556—A. M. Clark.
Steering apparatus—2347—A. M. Clark.
Sugar, manufacturing—2560—A. Smith.
Sunshades for windows—2513—J. Wilson.
Telegraphic wires and cables, manufacturing—2505—M. Gray and F. Hawkins.
Telegraphing on board ships—2495—B. Hellwag.
Telegraphs, &c.—2576—D. G. Fitz-Gerald.
Telegraphy, submarine—2547—J. Macintosh.
Valve motion—2513—J. T. and T. Fendlebury.
Watches, &c.—2387—A. Watkins.
Wool, carding—2477—G. Leach.
Wool, extracting burs from—2524—H. B. Walker.
Wool, &c., combing—2538—S. C. Lister.
Wool, &c., washing—2527—J. Petrie, jun.
Worsted, &c., dyeing warps of—2535—B. Ingham.
Yarns, sizing and drying—2570—C. J., W., A., and F. Simpson.

PATENTS SEALED.

592. W. R. Lake.	746. W. and T. Mitchell.
590. E. Baker.	750. J. Brigham & R. Bickerton.
691. H. B. Wilder.	752. C. R. Rockley.
695. G. Lindsley.	753. C. Schinz.
700. W. Barford and T. Perkins.	770. A. M. Clark.
710. T. Horsley.	772. D. Price and C. Rowe.
714. W. E. Gedge.	785. J. Houston, jun.
718. J. Barker.	788. J. Campbell.
720. W. B. Thompson and W. Gall.	796. R. Tooth.
721. J. A. Haswell & G. Brown.	833. S. Brooks.
722. J. Manly, jun.	834. E. and J. Broadbent.
723. W. Spence.	842. W. Hawthorn.
728. E. Burton and J. Lawrence.	877. J. Carter.
729. H. Kennedy.	920. A. V. Newton.
730. S. A. Bell & G. H. Higgins.	985. A. V. Newton.
733. B. W. A. Sleight.	1043. J. H. Johnson.
734. J. A. Lee.	1077. J. H. Johnson.
737. S. Jefferies.	1156. J. M. Plessner.
740. E. Clifton.	1467. J. Hickmott.
741. J. Lewthwaite.	1845. H. A. Bonneville.
744. W. K. Stuart.	1867. T. A. Weston.
745. J. G. Kincaid.	2086. G. H. Wilson.

From Commissioners of Patents' Journal, September 1.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2671. M. H. Blanchard.	2232. T. Wrigley and M. B. West head.
2215. G. Robinson.	2213. W. P. Piggott.
2264. W. Barford and T. Perkins.	2224. G. F. White and H. Cham berlain.
2192. F. Hazeldine.	2223. W. Clark.
2203. H. A. Bonneville.	
2196. F. A. E. G. de Massas.	

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2141. J. Ronald.	2233. R. A. Brooman.
2143. W. S. Guinness.	